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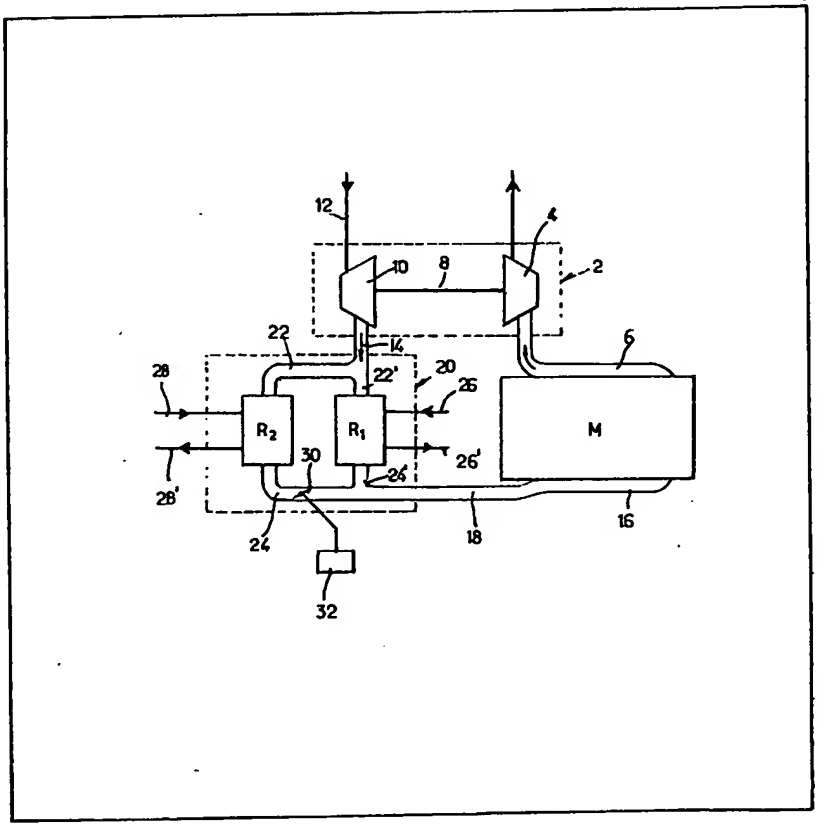
(54) A supercharged diesel engine

(57) A Supercharged diesel engine comprises first and second heat exchangers R_1 and R_2 having air circuits connected in parallel in the engine supercharging air supply circuit. The first heat exchanger R_1 has a coolant circuit 26, 26' fed with hot water from an engine cooling water circuit and the second heat exchanger R_2 has a coolant circuit 28, 28' fed with cold water. A valve 30 controls the relative air flow through the two heat exchangers and enables the temperature of the supercharging air to be selected according to the operating condition of the engine.



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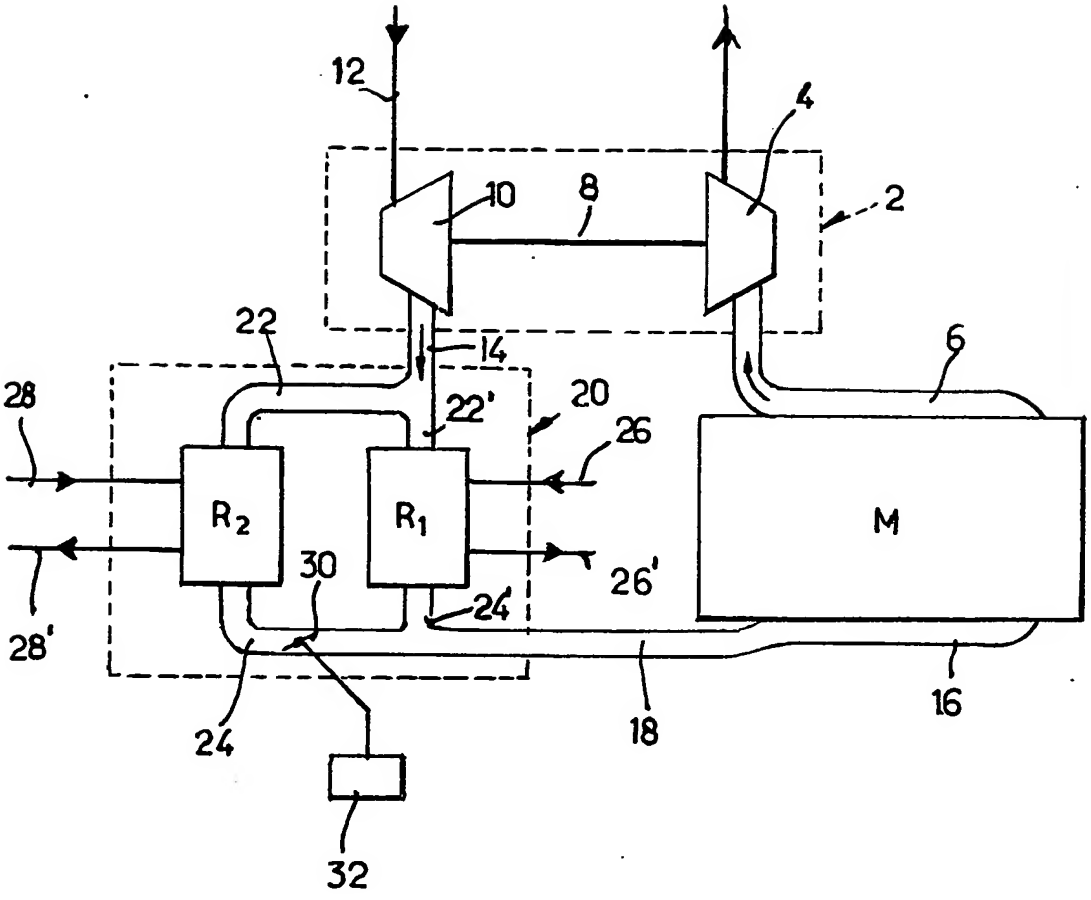
12
4
10
8
2
22
14
6
28
22'
20
26
R_2
R_1
M
30
26'
28'
24
24
18
16
32

SPECIFICATION

A supercharged diesel engine

This invention relates to supercharged diesel engines, more particularly supercharged low volumetric diesel engines.

In diesel engines supercharged by turbocompressor, it is common knowledge that it may advantageous to design the engine with a low volumetric ratio so that the compression ratio is less than 12 and, e.g., about 7 to 10. A greater weight of air can then be delivered to the engine, by high-pressure supercharging, so that greater power can be extracted per unit of engine capacity. However, with such a low compression ratio, it is difficult, if not impossible to start the engine because the fuel auto-ignition temperature is not achieved naturally.

Methods are already known, more particularly by heating the engine charging air, whereby these difficulties can be obviated and satisfactory operation obtained on starting and idling. For full-load operation, the supercharging air delivered to the engine by the high-pressure stage of the turbocompressor must be cooled, as is conventionally the case, by passing through one, and generally two, cooling stages in series.

However, although satisfactory results are obtained for the extreme operating conditions (starting, idling and full load), the operating characteristics at low load and part-load are not optimum.

This invention enables this disadvantage to be obviated very simply and economically by a specific arrangement of the coolants for the supercharging air in a compressor-supercharged diesel engine having a low volumetric ratio, and having a heat exchanger system comprising first and second heat exchangers connected in the engine air supply circuit between the compressor and the engine air intake.

The invention relates to an engine of this kind in which the first and second heat exchangers have their air supply circuits connected in parallel, fluid coolant circuits of the first and second heat exchangers are fed separately with fluids at different temperatures, and means are provided for adjusting the relative air flow through the two heat exchangers.

If the first exchanger carries a hot fluid, e.g. high-temperature engine cooling water, while the second heat exchanger carries a colder fluid, e.g. seawater in the case of a marine diesel engine, it is a simple matter, by means such as a valve, to adjust the air distribution through the two heat exchangers and hence feed the engine with air at the temperature best suited for the specific operating conditions of the moment.

Of course the means for adjusting the relative air flow, more particularly a valve, may be controlled automatically by a servo mechanism in dependence on any suitable operating parameter of the engine (e.g. temperature, pressure, load, etc.).

In order that the invention may be readily understood an embodiment thereof will now be described, by way of example, with reference to the accompanying drawing in which the single Figure is a diagram showing a supercharged diesel engine embodying the invention.

Referring to the drawings, a diesel engine M, which has a low volumetric ratio, e.g. less than 12, has a turbo-compressor supercharging unit 2 comprising at least one turbine 4 fed by the exhaust gases coming from the engine exhaust manifold 6, the turbine being connected by a shaft 8 to a compressor 10. The super-charging unit generally comprises two stages, although only one is shown, in order to simplify the drawing.

Compressor 10 draws atmospheric air in at its input 12 and delivers compressed air to the engine via its delivery conduit 14, which is connected to the engine intake manifold 16 via a pipe 18.

The engine air supply pipes 14 and 18 are interconnected with the interposition of a cooler 20 for the air supplied to the engine.

Unit 20 comprises first and second heat exchangers R_1 and R_2 connected in parallel in the engine air supply circuit via branch lines 22, 22' and 24, 24'.

The first exchanger R_1 has a circuit 26, 26' carrying a relatively hot fluid coolant. Circuit 26, 26' may for example, carry the high-temperature water from the water cooling circuit (not shown) of the engine.

The second heat exchanger R_2 has a circuit 28, 28' carrying a colder fluid coolant than the first heat exchanger. If the engine M is a diesel marine engine, the circuit 28, 28' of the second heat exchanger may carry seawater. If the engine is incorporated in a static installation, the circuit 28, 28' can be connected to a flow of mains water.

A shut-off member, e.g. a valve or flap 30, situated at one of the points of the engine air supply circuit between the two heat exchangers, e.g. in pipe 24, enables the air flow to be distributed optionally between the two heat exchangers.

In the case illustrated, therefore, hot air can be selected for partial or low loads, by keeping the flap 30 closed or partially closed. In that case all (or a high proportion) of the supercharging air passes solely through the "hot" heat exchanger R_1.

For heavy loads, the flap 30 is progressively opened, so that the engine is fed with cooled air, a higher proportion of the engine supply air then passing through the "cold" exchanger R_2.

Consequently, a very simple arrangement enables the engine to be supplied with air at the temperature most suitable for its state of operation. In addition, the parallel connection of the two exchangers reduces pressure losses.

Flap 30 can be controlled automatically by a servomechanism 32 in dependence upon one of the engine operation parameters, more particularly the supercharging pressure.

It may be advantageous to provide the servomechanism 32 with two adjustments "summer" and "winter", to allow for the ambient temperature, and of course other flaps may be provided at other points in the air circuit.

CLAIMS

1. A compressor-supercharged diesel engine having a heat exchanger system in the engine air

supply circuit between the compressor and the engine air intake, the said system comprising first and second heat exchangers having their engine air supply circuits connected in parallel, a fluid coolant circuit of the first heat exchanger being fed with fluid at a temperature above that of the fluid fed to a fluid coolant circuit of the second heat exchanger, means being provided for adjusting the relative air flow through the two heat exchangers, the fluid coolant circuit of the first heat exchanger being a water circuit connected to the engine cooling water circuit.

2. A diesel engine according to claim 1, wherein the fluid coolant circuit of the second heat exchanger is a water circuit for connection to a cold water source outside the engine.

3. A diesel engine according to claim 1 or 2, wherein the said adjusting means comprise at least one shut-off member disposed in the air supply circuit in a branch connecting the first and second heat exchangers.

4. A diesel engine according to claim 3, wherein the shut-off member is controlled automatically by a servomechanism.

5. A diesel engine according to claim 4, wherein the servomechanism is dependent on at least one of the engine operating parameters, e.g. the supercharging air pressure, temperature, or engine load.

6. A supercharged diesel engine substantially as hereinbefore described with reference to the accompanying drawing.

7. Any novel feature or combination of features described herein.

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ABSTRACT:

CHG DATE=19990617 STATUS=O> A Supercharged diesel engine comprises first and second heat exchangers R1 and R2 having air circuits connected in parallel in the engine supercharging air supply circuit. The first heat exchanger R1 has a coolant circuit 26, 26' fed with hot water from an engine cooling water circuit and the second heat exchanger R2 has a coolant circuit 28, 28' fed with cold water. A valve 30 controls the relative air flow through the two heat exchangers and enables the temperature of the supercharging air to be selected according to the operating condition of the engine. <IMAGE>